

SEQUENCE LISTING

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 <213> Rhizobium leguminosarum bv. trifolii

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			20					25					30		
Val	Val	Thr	Leu	Ile	Gly	Ala	Thr	Ala	Leu	Gln	Val	Ala	Ser	Asn	Val
			35				40					45			
Leu	Ile	Thr	Ile	Leu	Thr	Leu	Asn	Ile	Ala	Phe	Leu	Asn	Phe	Cys	Ser
			50				55				60				
Leu	Ile	Cys	Met	His	Asn	Leu	Lys	Arg	Gly	Ala	Lys	Ala	Asp	Val	Phe
			65			70				75				80	
Ala	Ala	Ile	Val	Arg	Ala	Ala	Cys	Met	Met	Ile	Gly	Val	Tyr	Leu	Ala
				85					90					95	
Leu	Ile	Ala	Val	Ser	Val	Ala	Thr	Leu	Glu	Gly	Ala	Pro	Arg	Thr	Gln
			100					105					110		
Thr	Ile	Ala	Phe	Ile	Ala	Leu	Ser	Ala	Leu	Arg	Pro	Phe	Val	Ala	Gly
			115					120					125		
Trp	Asn	Ala	Tyr	Cys	Ala	Glu	Val	Phe	Phe	Ala	Gln	Gly	Lys	Arg	Gln
			130				135					140			
Ile	Val	Arg	Ser	Val	Ile	Thr	Arg	Ser	Ser	Leu	Ile	Tyr	Ala	Gly	Val
			145				150			155				160	
Asn	Leu	Leu	Phe	Val	Gly	Leu	Ser	His	Phe	Ala	Gly	Thr	Gln	Asn	Ser
				165					170					175	
Ile	Ile	Ser	Leu	Leu	Ile	Gly	Val	Tyr	Leu	Ala	Leu	Phe	His	Asn	Ala
			180					185					190		
Leu	Ala	Tyr	Ala	Arg	Ile	Leu	Pro	Thr	Glu	Trp	Arg	Phe	Ser	Arg	Gln
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Asp	Leu	Lys	Asp	Val	Phe	Ser	Leu	Arg	Lys	Leu	Asp	Leu	Val	Gly	Ile
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Gly	Ala	Gly	Leu	Ser	Ala	Ser	Phe	Ile	Asn	Met	Leu	Glu	Met	Gly	Phe
			225			230				235				240	
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				245					250					255	
Val	Phe	Tyr	Phe	Pro	Phe	Phe	Thr	Leu	Val	Glu	Leu	Thr	Ser	Gly	Leu
			260				265					270			
Ala	Ile	Gly	Leu	Gly	Arg	Ser	Val	Thr	Glu	Arg	Leu	Ile	Thr	Pro	Arg
			275				280					285			
Pro	Phe	Pro	Arg	Leu	His	Val	Leu	Ile	Ala	Val	Tyr	Ser	Thr	Tyr	Ser
			290				295				300				
Leu	Leu	Cys	Phe	Leu	Ile	Tyr	Val	Gly	Leu	Ile	Gly	Val	Ser	Asn	Arg
				310					315					320	
Asp	Ile	Phe	Ala	Leu	Pro	Leu	Ser	Leu	Ala	Gly	Leu	Ala	Leu	Leu	Phe
				325					330					335	
Leu	Ile	Cys	Asp	Gly	Leu	Gln	Leu	Val	Val	Arg	Gly	Tyr	Thr	Leu	Ala

340	345	350
Lys Ala Asp Gly Lys Leu Thr His Leu Ser Ala Ile Ala Tyr Leu		
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Ala Ser Gly Val Ile Leu Ala Leu Ala Val Leu Gly Ser Val Gln		
370	375	380
Ala Leu Ala Ile Ala Leu Val Leu Gly Pro Leu Phe Leu Ala Ile Ser		
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Ile Pro Ala Val Gln Ser Arg Thr Ala Leu Asn Ala Leu Pro Asn Arg		
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 <211> 258
 <212> PRT
 <213> Rhizobium leguminosarum bv. trifolii

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Glu His Leu Glu Val Pro Glu Ala Tyr Phe Gln Ala Tyr Asp Pro Leu		
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Thr Thr Trp Phe Glu Trp Phe Ser Arg Ile Gly Tyr Arg Asp Tyr Thr		
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Asp Ala Glu Ala Glu Ile Glu Arg Asp Ala Glu Glu Asn Val Arg Gln		
65	70	75
His Gln Val Ser Val Gln Pro Asp Leu Thr Leu Thr Gln Arg Leu Ser		
85	90	95
Ser Glu Gly Ser Ile Gln Leu Pro Val Pro Phe Leu Lys Thr Ala Asp		
100	105	110
Gln Phe Cys Ile Leu Ser Ser Leu Leu Tyr Ala Gly Phe Gly Val Val		
115	120	125
Glu Thr Arg Lys Phe His Gly Asp Thr Ile Phe Leu Lys Asn Val Pro		
130	135	140
Ser Val Gly Ala Arg His Gly Ile Glu Ala Tyr Val Ser Leu Asp Asp		
145	150	155
Gly Arg Tyr Tyr Tyr Asp Cys Glu Gln His Arg Leu Phe Ser Ala Gly		
165	170	175
Tyr Arg Gly Asp Leu Arg Ser Gly Gln Ile Asp Ile Val Phe Arg Pro		
180	185	190
Glu Val Tyr Met Trp Arg Tyr Gln Thr Ala Ala Cys Leu Ala Asp Val		
195	200	205
Tyr Leu Asp Leu Gly His Ile Leu Gly Thr Leu Ser Met Val Ala Ser		
210	215	220
Leu Tyr Asp Thr Ser Ile Thr Ser Arg Ser Ala Glu Ala Ala Pro Val		
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Asp Leu Ile Asn Ala Val His Leu Gln Arg Ile Ala Val Asp Gly Phe		

Asn Pro

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<210> 6
 <211> 261
 <212> FRT
 <213> Rhizobium leguminosarum bv. trifolii

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 35 40 45
 Pro Ser Val Val Gly Thr Gly Phe Asp Glu Arg Gly Arg Glu Thr Leu
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 Ser Phe Ile Glu Gly Glu Phe Val His Pro Gly Pro Trp Ser Glu Glu
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 Ala Phe Pro Gln Phe Gly Met Met Leu Arg Arg Leu His Asp Ala Thr
 85 90 95
 Ala Ser Phe Lys Pro Pro Glu Asn Ser Met Trp Arg Asp Trp Phe Gly
 100 105 110
 Arg Asn Leu Gly Glu Gly Gln His Val Ile Gly His Cys Asp Thr Gly
 115 120 125
 Pro Trp Asn Ile Val Cys Arg Ser Gly Leu Pro Val Gly Leu Ile Asp
 130 135 140
 Trp Glu Val Ala Gly Pro Val Arg Ala Asp Ile Glu Leu Ala Gln Ala
 145 150 155 160
 Cys Trp Leu Asn Ala Gln Leu Tyr Asp Asp Ile Ala Glu Arg Val
 165 170 175
 Gly Leu Gly Ser Val Thr Met Arg Ala His Gln Val Arg Leu Leu Leu
 180 185 190
 Asp Gly Tyr Gly Leu Ser Arg Lys Gln Arg Gly Gly Phe Val Asp Lys
 195 200 205
 Leu Ile Thr Phe Ala Val His Asp Ala Ala Glu Gln Ala Lys Glu Ala
 210 215 220
 Ala Val Thr Pro Glu Ser Asn Asp Ala Glu Pro Leu Trp Ala Ile Ala
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 Glu Ala Ala Leu Ala
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<210> 7

<211> 7142
 <212> DNA
 <213> Rhizobium leguminosarum bv. trifolii

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 <223> tfxC coding sequence

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 <223> tfxE coding sequence

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 Lys Asp Leu Leu Thr Ala Asp Ser Phe Ser Phe Thr Asp Val Glu Leu
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 Asp Leu Ala Ala Ser Val Ala Asp Ala Leu Asp Val Asp Gln Thr Thr
 55 60 65

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Ala Leu Ala Ala Ile Glu Ala Leu Val Glu Leu Gly Leu Leu Val Pro	
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Ser Ala Ser Ile Ser Ser Gln Lys Ala Gly Ile Gln Leu Trp Val Asp	
85 90 95	
aag gga tgg gtg gac gca ctg atc ctg cat ttc gcg agc aga aat ctc	2252
Lys Gly Trp Val Asp Ala Leu Ile Leu His Phe Ala Ser Arg Asn Leu	
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cgc gat ata gct ttc gac agc gcc ttc tca gcg ttg tcc acc ttt gtt	2588
Arg Asp Ile Ala Phe Asp Ser Ala Phe Ser Ala Leu Ser Thr Phe Val	
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gtc aca tat gga cag atc gat tgg cag gat ggc tcg ttg cca ccc gga	2636
Val Thr Tyr Gly Gln Ile Asp Trp Gln Asp Gly Ser Leu Pro Pro Gly	
230 235 240	
gtc tat cgt tac aat gtc gtc aat cac gaa ctt gaa gca atc aga gcc	2684
Val Tyr Arg Tyr Asn Val Val Asn His Glu Leu Glu Ala Ile Arg Ala	
245 250 255	

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gct tcg agc ggg cta ttc acg ttt gtg atc tgc ggc gat ttg aag tca 2780
Ala Ser Ser Gly Leu Phe Thr Phe Val Ile Cys Gly Asp Leu Lys Ser
280                285                290

tac aca tcg cgg tac agg cac gag cgg agc tac cgc aat ctg ctg atc 2828
Tyr Thr Ser Arg Tyr Arg His Glu Arg Ser Tyr Arg Asn Leu Leu Ile
295                300                305

aac acc tca cag ctc gcc caa ttc tat ttg acc ctc gca acg atc aac 2876
Asn Thr Ser Gln Leu Ala Gln Phe Tyr Leu Thr Leu Ala Thr Ile Asn
310                315                320

gac ttc aac acc ttt ctc acg ccc gcc atc cac gat gag aaa atg cat 2924
Asp Phe Asn Thr Phe Leu Thr Pro Ala Ile His Asp Glu Lys Met His
325                330                335

ctg ttt ctt gaa gcg gag gac gac ctc cgg ctt tat ctc gtc acg gca 2972
Leu Phe Leu Glu Ala Glu Asp Asp Leu Pro Leu Tyr Leu Val Thr Ala
340                345                350                355

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gttccttgca atctccattc ccgcggttca aagtcgaact gccctaa atg cac tac 4221
Met His Tyr

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Arg Thr Asp Lys Pro Lys Val Phe Val Thr Asp Ser Gly Arg Phe Val
360 365 370 375

gct gac tgc cag ata att ctg ctt ggt cgc aag atc ata tgt acg gga 4317
Ala Asp Cys Gln Ile Ile Leu Leu Gly Arg Lys Ile Ile Cys Thr Gly
380 385 390

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395 400 405

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410 415 420

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Arg Glu Ser Val Thr Leu Pro Leu Ser Leu Phe Val Thr Arg Pro His
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cgg cgc aag gca gca att gaa cac gcg gtc aat gag gtt tta gag cgc 4605
 Arg Arg Lys Ala Ala Ile Glu His Ala Val Asn Glu Val Leu Glu Arg
 475 480 485

ggc tgg aac gct cgg ttt cga cga gat cag cag tct ctt ctt aag ttg 4653
 Gly Trp Asn Ala Arg Phe Arg Arg Asp Gln Gln Ser Leu Leu Lys Leu
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ctc cgc cag gtt tcc tac tgc ttg gcc aac gcc cgt gtt gcg gga cat 4749
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gtc ggt tgg ggt tcc gca gtt cgc aga acg acc gaa gcg gca gtg gaa 4797
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 Tyr Val Ile Gln Ala Val Ser Tyr Ser
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<210> 8

<211> 356

<212> PRT

<213> Rhizobium leguminosarum bv. trifolii

<400> 8

Met	Ile	Glu	Leu	Arg	Pro	Leu	Leu	Gln	Leu	Asn	Leu	Glu	Asp	Gly	Ile
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Pro	Val	Leu	Lys	Asp	Leu	Leu	Thr	Ala	Asp	Ser	Phe	Ser	Phe	Thr	Asp
			20					25					30		
Val	Glu	Leu	Leu	Arg	Tyr	Ile	Pro	Ala	Ile	Ala	Lys	Asn	Thr	Pro	Ala
		35					40					45			
Gln	Thr	Arg	Asp	Leu	Ala	Ala	Ser	Val	Ala	Asp	Ala	Leu	Asp	Val	Asp
	50					55					60				
Gln	Thr	Thr	Ala	Leu	Ala	Ala	Ile	Glu	Ala	Leu	Val	Glu	Leu	Gly	Leu
	65				70					75				80	
Leu	Val	Pro	Ser	Ala	Ser	Ile	Ser	Ser	Gln	Lys	Ala	Gly	Ile	Gln	Leu
				85					90					95	
Trp	Val	Asp	Lys	Gly	Trp	Val	Asp	Ala	Leu	Ile	Leu	His	Phe	Ala	Ser
			100					105					110		
Arg	Asn	Leu	Asn	Tyr	Asn	Asp	Asp	Pro	Ile	Glu	Phe	Gly	Gly	Leu	Glu
		115					120					125			
Asp	Ile	Lys	Ser	Tyr	Pro	Glu	Pro	Met	Glu	Ser	Lys	Arg	Arg	Lys	Arg
	130					135					140				
Gly	Thr	Ala	Thr	Arg	Leu	Val	Lys	Pro	Ser	Arg	Glu	Leu	Ala	Ala	Ala
	145				150					155				160	
Val	Ile	Leu	Asp	Gly	Leu	Met	Asn	Arg	Arg	Ser	Phe	Lys	Pro	Phe	Thr
			165					170						175	
Arg	Lys	Gln	Leu	Ser	Ile	Thr	Glu	Val	Ser	Glu	Ile	Leu	Trp	Phe	Gly
		180						185					190		
Asn	Leu	Tyr	Ala	Arg	Glu	Arg	Ala	Val	Ile	Ala	Glu	Asn	Arg	Asp	Phe
		195					200					205			
Glu	Ser	Pro	Arg	Asp	Ile	Ala	Phe	Asp	Ser	Ala	Phe	Ser	Ala	Leu	Ser
	210					215								220	

Thr Phe Val Val Thr Tyr Gly Gln Ile Asp Trp Gln Asp Gly Ser Leu
 225 230 235 240
 Pro Pro Gly Val Tyr Arg Tyr Asn Val Val Asn His Glu Leu Glu Ala
 245 250 255
 Ile Arg Ala Gly Asp Phe Lys Leu Asp Met Ala Lys Leu Ala Ile Gly
 260 265 270
 Gln Ser Arg Ala Ser Ser Gly Leu Phe Thr Phe Val Ile Cys Gly Asp
 275 280 285
 Leu Lys Ser Tyr Thr Ser Arg Tyr Arg His Glu Arg Ser Tyr Arg Asn
 290 295 300
 Leu Leu Ile Asn Thr Ser Gln Leu Ala Gln Phe Tyr Leu Thr Leu Ala
 305 310 315 320
 Thr Ile Asn Asp Phe Asn Thr Phe Leu Thr Pro Ala Ile His Asp Glu
 325 330 335
 Lys Met His Leu Phe Leu Glu Ala Glu Asp Asp Leu Pro Leu Tyr Leu
 340 345 350
 Val Thr Ala Gly
 355

<210> 9

<211> 252

<212> PRT

<213> Rhizobium leguminosarum bv. trifolii

<400> 9

Met His Tyr Arg Thr Asp Lys Pro Lys Val Phe Val Thr Asp Ser Gly
 1 5 10 15
 Arg Phe Val Ala Asp Cys Gln Ile Ile Leu Leu Gly Arg Lys Ile Ile
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 Cys Thr Gly Thr Asp Leu Gln Tyr Glu Ile Ala Val Ala Lys Ala Lys
 35 40 45
 Ser Glu Leu Ala Glu Arg Ile Ala Phe Ala Ser Pro Asp Ala Phe Asn
 50 55 60
 Ala Arg Val Thr Arg Val Ala Arg Arg Leu Met Leu Glu Ala Thr Asn
 65 70 75 80
 Ala Phe Asn Arg Glu Ser Val Thr Leu Pro Leu Ser Leu Phe Val Thr
 85 90 95
 Arg Pro His Leu Cys Trp Met Arg Gly Asn Asn Ser Thr Gly Phe Ala
 100 105 110
 Ala His Pro Arg Arg Lys Ala Ala Ile Glu His Ala Val Asn Glu Val
 115 120 125
 Leu Glu Arg Gly Trp Asn Ala Arg Phe Arg Arg Asp Gln Gln Ser Leu
 130 135 140
 Leu Lys Leu Ala Thr Ile Arg Arg Asp Gly Ser Thr Ala Trp Val His
 145 150 155 160
 Glu Ser Arg Leu Arg Gln Val Ser Tyr Cys Leu Ala Asn Ala Arg Val
 165 170 175

Ala	Gly	His	Val	Gly	Trp	Gly	Ser	Ala	Val	Arg	Arg	Thr	Thr	Glu	Ala
			180					185					190		
Ala	Val	Glu	Ala	Ala	Thr	Ser	Glu	Ala	His	Ala	Met	Ser	Ala	Ser	Gly
		195					200					205			
Gln	Asp	Tyr	Gly	Arg	Gly	Gly	Thr	Gly	Val	Ser	Glu	Leu	Pro	Ser	Gln
	210					215					220				
His	Asp	Gln	Ile	Ala	Phe	Val	Glu	Arg	Gln	Pro	Val	Arg	Ile	Asp	Asp
225					230					235					240
Val	Thr	His	Tyr	Val	Ile	Gln	Ala	Val	Ser	Tyr	Ser				
				245					250						